

Water Wars

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Water Wars

July 2003



The Council of
State Governments

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Executive Summary

States are suing the federal government. States are suing each other. Cities and rural communities are at odds. What is the source of all this controversy? Water rights. Water, which used to be considered a ubiquitous resource, is now scarce in some parts of the country, and not just in the West as one might assume. The water wars have spread to the Midwest, East and South as well.

This *TrendsAlert* highlights some of the major water conflicts in the country today and provides an overview of state water laws. To put the situation into perspective, this report examines factors that influence both water supply and water demand. It concludes with a synopsis of policy options available to states to prevent, or at least deal with, water supply shortages and increasing demand for water resources.

To understand the water wars occurring throughout the country, state officials should realize that:

- When there are disputes within states over any water rights laws, these conflicts can be hashed out in state courts. On the other hand, an absence of overriding federal law makes solving interstate conflicts difficult, although there are several ways to deal with interstate disputes.
- Recent water shortages are putting several water rights conflicts in the spotlight. These conflicts are occurring within states, among states, between states and the federal government and among environmentalists and state and federal agencies. In addition, Native Americans are pursuing several legal battles to reclaim their water rights.
- A number of conditions have combined to create the current crisis. First, the recent drought, water quality issues, overallocation and overuse of water sources, aging water infrastructure and land development have affected water supply. Second, population growth and trends in water usage are putting higher demands on water sources.
- To alleviate water supply problems, states can promote transfers of water rights, create drought plans, encourage good water quality through mechanisms such as minimum streamflow requirements, discourage overuse, improve infrastructure quality and integrate water planning with land use planning.
- On the demand side, there is a wide variety of conservation programs. These include measurement of water usage, pricing structures that promote efficient water use, water audits, promotion of efficient landscaping and irrigation, water reuse and recycling, management of water system pressure, retrofit and replacement of inefficient fixtures and appliances, and conservation education.
- States should also consider comprehensive water plans that address both supply and demand issues.

1. The present situation – conflicts over water rights

Recent water shortages are putting water rights conflicts in the spotlight. These conflicts are occurring within states, among states, between states and the federal government and among environmentalists and state and federal agencies. In addition, Native Americans are pursuing several legal battles to reclaim their water rights. And water conflicts don't stop at the U.S. border. The United States and Mexico are currently in a dispute over water rights to the Rio Grande.

Intrastate Issues

Many intrastate conflicts highlight the disconnect between rural and urban water interests. In rural areas, farmers want water for irrigation. Growing populations in urban areas, however, want water to supply increasing residential and industrial demand. While these intrastate conflicts are relatively common in some areas of the West, they are no longer confined to the western half of the country.

Some conflicts pit private citizens against local governments. Last fall, for example, cities in North Carolina discovered they have little legal leverage over water use. Officials found people diverting water for private use at the expense of downstream cities. In the town of Shelby, a landowner constructed a rock dam that blocked the town's water supply to the town. City workers destroyed the dam but later had to apologize because they did not have the legal authority to do so.

The clash between urban and rural water interests is evident in Georgia, where the rapidly sprawling Atlanta metropolitan area limits the amount and quality of freshwater available for farming communities downstream. Atlanta has a large and growing demand for water. To put the situation in perspective, Atlanta is currently consuming water at its projected 2030 level.¹ Since the Flint River in central Georgia has its headwaters at Atlanta's Hartsfield International Airport, urban use is a major cause of water pollution and scarcity in the watershed.

There are intrastate disputes in the Midwest as well. A rancher in Nebraska sued the state in 2002 and sued upstream landowners in 2003. His first suit claimed state government failed to protect his water rights from upstream users. This case is interesting because it shows the disconnect between surface water rights and groundwater rights in some states. (Water law will be discussed below). In Nebraska, surface water rights are obtained from the state while groundwater users do not have to obtain water rights. The rancher had obtained his surface water rights to the disputed river, but his water supply was being depleted by farmers using wells to tap into groundwater.

Interstate Issues

Several interstate compacts exist to deal with potential disputes among states concerning water rights along major river systems. The existence of compacts, however, does not preclude states from going to court to protect the provisions of these agreements.

In the East, Maryland and Virginia are arguing over rights to the Potomac River. The disagreement is an interesting case stemming from a decree issued before the United States was formed. Maryland claims jurisdiction over the river based on a 1632 decree from King Charles I. The dispute has intensified as water has become scarce. Utility companies in both states are taking so much water that the river can no longer sustain itself. While the dispute is ongoing, a court-appointed overseer recommended in December 2002 that Virginia should be able to use the river without Maryland's permission.

In the Midwest, Kansas, Nebraska and Colorado recently settled a multiyear legal fight over the use of water from the Republican River Basin. In 1998, Kansas sued Nebraska in the U.S. Supreme Court. Kansas claimed that irrigators in Nebraska were taking more than their fair share of the water. Nebraska argued that the existing compact did not pertain to groundwater use. Colorado joined the suit against Nebraska in order to protect the water it is entitled to under a 1943 compact among the three states. As part of the recent agreement, Nebraska is to use the water reasonably and the three states have agreed to use a common computer model to show what amount and when each state should get water.

A prominent example of an interstate disagreement in the South involves Alabama, Florida and Georgia. The three states have been at odds for more than a decade. The water conflict has its origins in the rapid growth of the Atlanta metropolitan area in the 1980s and 1990s that, together with recurrent periods of drought, has strained the water resources of the Apalachicola-Chattahoochee-Flint and the Alabama-Coosa-Tallapoosa River Basins.

When the Army Corps of Engineers built these reservoirs, reservoir storage was supposed to be used for flood control, navigation, recreation and power production in the basins. However, in 1989 the Corps approved Georgia's request for reallocation of reservoir storage to meet the growing water demands for domestic use, recreation and hydropower. Alabama and Florida filed litigation challenging the Corps' decision. State officials, business owners and farmers in Alabama are concerned about the threats to their own water supply, water availability for local economic development and degraded water quality caused by the decrease in water flow. Florida's concerns are mostly environmental and focus on the threats that the decreased freshwater flow poses to fish in the Apalachicola River and oysters in the Apalachicola Bay.

Recently, federal officials proposed a compromise agreement. The three states haven't signed it, however, because of a clause about when droughts should be declared. Critics believe that droughts can be declared too easily and that Georgia could withhold water from the other two states.

In the West, California's use of the Colorado River provides an interesting case of an interstate conflict that has turned into an intrastate disagreement. The Colorado River Compact represents a compromise among the states of the rapidly developing Lower Basin (New Mexico, Arizona, Nevada and California) and the largely rural Upper Basin (Wyoming, Utah and Colorado). The river infrastructure consists of dams and canals that divert, store and deliver water to millions of consumers in urban areas and millions of acres of cultivated farmland. The compact ensures the Upper Basin's water rights, permitting Lower Basin states to put the unused water of the Upper Basin to a beneficial use until the latter develops uses for its share of the water. Each basin is entitled to half of the river's annual yield.

The problem is that the allocations are 20 percent more than actual yields, because the original forecasters predicted more yield than there turned out to be. When the Colorado River Compact was signed in 1922, the lack of urban development and the abundance of unexercised water rights left a surplus in the river that adequately satisfied all water consumers. Today, those downstream localities that were previously sustained by the surplus water are now facing shortages. Consequently, California must decrease its use of the Colorado River. The state must now allocate this decreased water supply between farmers and urban users, which has led to contentious debate.

State versus Federal Interests

The federal government, as some of the previous examples have shown, is also involved in the water wars. States must deal with a host of federal actors that sometimes have conflicting points of view – the Army Corps of Engineers, Bureau of Reclamation, Environmental Protection Agency and the Fish and Wildlife Service. The Army Corps of Engineers focuses on water for navigation and flood control, while the Bureau of Reclamation in the Department of the Interior focuses on building and controlling dams and power plants in the Western states for all types of water use and hydroelectricity. The EPA is concerned with water pollution and safe drinking water, while the Interior Department's Fish and Wildlife Service deals

with gaming fish. Sometimes these agencies and their goals are in sync, but other times they conflict. This is often a source of frustration for state officials and private water rights holders.

The Army Corps of Engineers is facing several lawsuits regarding its handling of water issues along the Missouri River. For example, South Dakota and Nebraska are seeking to intervene in a lawsuit North Dakota has filed against the Corps of Engineers over Missouri River flows. North Dakota claims that the Corps' plans to divert water for downstream barges will cause water pollution and won't leave enough cold water needed by salmon, walleye and other fish. South Dakota claims the diversion will hurt fishing and recreation, and Nebraska wants to ensure sufficient water for power generation, recreation, wildlife, agriculture, domestic use and barge navigation.

Colorado and the federal government have been battling for decades over water rights to the Gunnison River of the Gunnison National Park. The National Park Service was granted water rights in 1971, and in 1978 a court granted the service an unquantified amount of water to preserve the park's scenic beauty and wildlife. In the 1990s, the park service tried to quantify that amount, but farmers, state officials and other water users thought the park service's estimate was excessive. Opponents claimed that hydroelectric generation would be impeded and some areas would be prone to increased flooding if the agency took such a large amount of water for the park.

The parties recently came to an agreement that quantifies the water rights and requires Colorado to buy water rights to any unappropriated water in the river. In an effort to foster state-federal cooperation and cooperation among federal agencies, the agreement also requires the Bureau of Reclamation, the Fish and Wildlife Service and the Colorado Water Conservation Board to periodically discuss water flows and water management.

Environmental Interests

Environmentalists have filed a number of lawsuits and have tried to purchase water rights in order to preserve aquatic life and the ecology of watersheds. One of the major issues for environmental groups is enforcement of the Endangered Species Act.

In November 2000, wild Atlantic salmon in eight Maine rivers were added to the list of endangered species. Later, however, the scope was widened to include watersheds upon which the salmon were dependent, essentially expanding the protection to much of the state's water.

This invocation of the Endangered Species Act has impacted Maine's aquaculture, agriculture and forestry interests. Salmon farmers now face new regulations. For instance, they have to tag their fish so the salmon can be traced back to the individual farms if they escape. Aquaculture farms can no longer use European fish – which are large, grow quickly and are disease-resistant – to breed other fish because government scientists are concerned about nonnative fish escaping from farms and breeding with wild salmon. Salmon farmers claim that banning these breeds will put them at a disadvantage on the world market.

Maine's agricultural interests have been affected as well. Blueberry farmers can no longer take water from rivers for irrigation, and limits have been placed on pesticide use. Farmers now have the added cost of building runoff-collection ponds or drilling wells because environmentalists fear that lowering water levels may raise

water temperature and hurt the fish. The forestry industry is concerned because lumbering is limited around these rivers due to fear of runoff.

The Endangered Species Act got a major boost in May 2003 when a U.S. Court of Appeals ruled that the federal government must consider all available sources of water in determining how to conserve the dying Rio Grande ecosystem and protect the endangered silvery minnow. In essence, water supplies for farmers and residents along the Rio Grande in New Mexico, Colorado, Kansas, Oklahoma, Utah and Wyoming will be reduced. Because part of the water in question is owned by the Middle Rio Grande Conservancy District, this ruling also indicates that private water rights can be taken to preserve endangered species.

While environmental groups have won victories in the implementation of the Endangered Species Act, environmentalists in Texas were unsuccessful in their recent attempt to buy water rights. A Texas state environmental agency denied an environmental group's request for Guadalupe River rights. The group wanted the water to preserve the river's aquatic life. Opponents of the request feared it could set a precedent that could allow water in all of the state's rivers to be set aside for wildlife rather than for human use. The environmental group claimed the agency has issued permits for more water than is available from the state's rivers and that the state has disregarded studies showing how much water is needed in order to keep the aquatic life healthy.

Native American Interests

Native American water rights are often the oldest such rights. However, they are not always enforced. In recent years, Native American tribes have been taking their disputes to the courts, and there has been a trend toward enforcing Native American rights.

For example, a complex battle is raging on the Klamath River, pitting farmers from California's Central Valley against anglers, environmentalists and the Hoopa tribe. The two sides are fighting over flow: farmers want to irrigate their crops, Indians and commercial fishermen want to protect their fish supply and environmentalists want to protect a threatened type of salmon which is protected under the Endangered Species Act. In 2001, the Bureau of Reclamation shut off diverted flows to California's Central Valley in order to protect endangered salmon. Farmers protested, forcing open irrigation gates and carrying buckets of water to irrigation ditches. The following year, in response to this public pressure, the federal government gave farmers their full allotment of water. When 33,000 salmon later died, anglers and environmentalists blamed the problem on historically low streamflows.

After originally deciding to cut off irrigation flows to the Klamath project in order to protect the fish, the Bureau of Reclamation agreed to release limited irrigation flows. There are still a number of ongoing lawsuits. For instance, the Hoopa tribe has sued the Bureau of Reclamation for providing irrigation water to Klamath Project farmers. In addition, the Westlands Water District (which pumps water from the Trinity River, a major tributary of the Klamath, to the Central Valley) is suing the bureau over a promise to the Hoopa tribe to restore flow on the Trinity to 50 percent of historical levels.

While the problems in the Klamath River Basin continue, a long-standing dispute involving Native American water rights has recently been resolved. The Luiseno Indians in California recently ended a 70-year battle with southern California water agencies. The tribe had claimed that an aqueduct built by water agencies drained

“reasonable.” Second, water rights are not transferable on their own because they are tied to land adjacent to a body of water. Third, some states place constraints on using water on nonriparian land. And fourth, it is generally unknown how much water riparian landowners are allowed to take out of waterways.

Prior Appropriation Law

Unlike riparian law, land ownership does not constitute a basis for an appropriation water right. In such cases, ownership of a water right is totally independent from ownership of the land on which the water originates. With prior appropriation law, individuals or organizations can own the right to use water. Farmers and irrigation districts own most of the water rights in the West.

All people, corporations and municipalities have a right to appropriate water for “beneficial purposes.” Such uses are generally defined by statute, although some states are more specific than others. Beneficial uses typically include agriculture, industrial uses, mining and municipal water supplies. Environmental and recreational concerns are increasingly being seen as beneficial uses. In contrast to riparian law, appropriation rights are not subject to a “reasonable use” limitation. If a senior appropriator can show that it is using all of its allotment for a beneficial use, the senior rights holder could conceivably drain a river dry without consideration for junior appropriators.

Demand for water rights exceeds supply, so this legal system gives the right to use a water resource to the person who used it first. Appropriation is thus hierarchical, with senior appropriators’ rights taking precedence over those of junior appropriators.

As with riparian law, there are some downsides to prior allocation law. First, water rights are maintained by continual usage and need (use it or lose it). Failure to use a water allocation can lead to a forfeiture of the right, and this impedes conservation efforts because rights holders have a disincentive to conserve water. Second, although water rights can be transferred in certain circumstances, the procedure is often difficult, time-consuming and costly. Third, because of its hierarchical nature, prior allocation law lends itself to conflicts between rights holders.

The differences between riparian and prior appropriation laws are fading. In the East, some states are using what is called regulated riparianism, in which a state agency decides before a right is granted whether the use is reasonable and may require water registration and permitting systems. In the West, states are increasingly regulating the appropriation of water, requiring minimum streamflows, environmental considerations and permits for taking water.

Groundwater Law

Groundwater law, like most other types of water law, is based on common or civil law. However, since groundwater is mostly hidden from view and thus historically less well understood than surface water, it is treated differently.

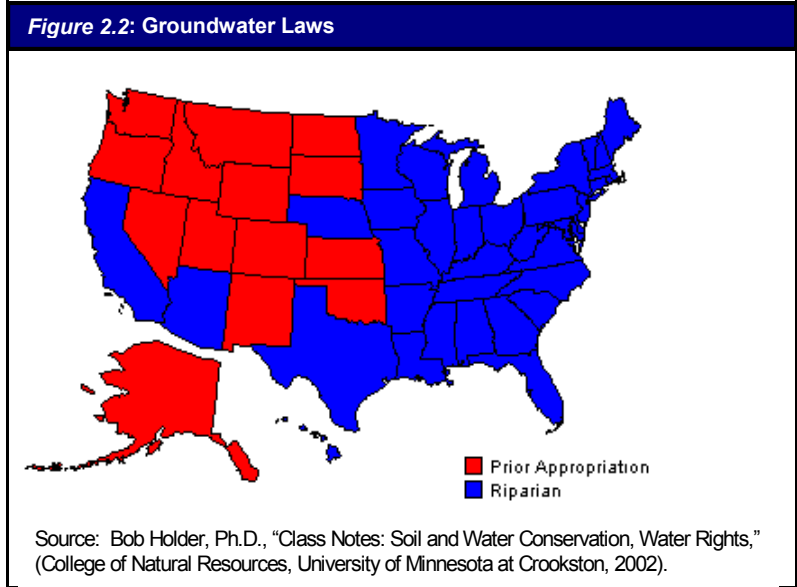
There are three major ways of allocating groundwater in the United States. The first two are loosely compatible with the two primary categories of surface water law. Many Western states use the doctrine of prior appropriation, while states that operate under riparian law typically rely on the “American Rule” of reasonable use. A small handful of states, notably Texas, use the “English Rule of Capture.”

Prior Appropriation

As with surface water law, under prior appropriation law, rights are established by seniority: the first person to use the groundwater retains the first right by continuing to use the water for beneficial purposes.

Reasonable Use

The "American Rule" of reasonable use requires that a landowner's use of groundwater must be reasonable. States typically define "reasonable use" through administrative and court decisions, often on a case-by-case basis. Most states that use the American rule have also adopted the doctrine of correlative rights, which subjects individual rights to the rights and needs of other landowners who rely on the same water source. In California, for instance, this doctrine requires water rights holders to correlate with others' uses in times of shortage.



English Rule of Capture

The "English Rule of Capture," also known as "absolute dominion," gives landowners the absolute right of ownership to water underneath their land. This right allows landowners to use as much groundwater as they can take from their land, regardless of the effect on neighbors' ability to pump water. In areas with scarce water supplies, this can lead to a free-for-all where landowners have a choice between draining an aquifer or letting their neighbor drain it instead.

Conflict Resolution

When there are disputes within states over any water rights laws, these conflicts can be hashed out in state courts. On the other hand, an absence of overriding federal law makes solving interstate conflicts difficult, although there are several ways to resolve interstate disputes.³

Private lawsuit between water users in different states. Note that the parties are individuals, not states, and that this usually takes place in state courts. Why? Since state agencies administer water rights, they'd likely be a party to the suit, and citizens of one state can't sue another state in federal court. The harm must take place in the plaintiff's state, although the case might be heard in either state's court.

"Equitable apportionment" suit between different states, originating before the U.S. Supreme Court. The court uses federal common law to make these decisions, but states generally don't like these cases because their outcomes are unpredictable. The U.S. Supreme Court will not decide issues involving future use and does not allocate unused water. Furthermore, the Court is choosy in which cases it will hear. A state must show that it has been or is currently being harmed by another state's decisions. Speculative harm isn't acceptable. Most litigation appears in

state and federal courts and can take 10 years or more to settle, and these suits are very expensive.

Allocation by act of Congress. This typically only applies to navigable waters, which Congress can control via the constitutional power to regulate interstate commerce. This has only happened once in U.S. history.

Informal agreement between states that does not qualify as a compact. Because the agreement is not a formal compact, it does not require federal approval. This method hasn't been used often in the past, but if states can reach agreement, this could be a preferable alternative to traditional interstate compacts by providing many of the benefits while reducing some of the more expensive drawbacks.

Allocation through interstate compact. Compacts must be ratified by Congress and signed by the president. Frequently, the federal government is a party as well. There are currently 23 water compacts in force in the United States. Most federal water rights cases involve some sort of dispute arising from these agreements – especially those heard before the Supreme Court, which has original jurisdiction over interstate compacts.

Water conflicts are gaining more attention as the supply of water diminishes while demand for water is growing. Issues with both water supply and water demand are discussed below.

3. Putting the situation into perspective – the law of supply and demand

A number of conditions have combined to create the current crisis. Recent drought, water quality issues, overallocation and overuse of water sources, aging water infrastructure and land development have affected water supply. At the same time, population growth and trends in water usage are putting higher demands on water sources.

Water Supply Issues

Water supply depends on a variety of factors, including changes in climate conditions, changes in water quality, overallocation and overuse, infrastructure quality and patterns of land use.

Changes in Climate

Climate changes over the last few years have brought many water problems to the forefront. The United States has been in a drought for four years. While the West is somewhat accustomed to dry periods, drought conditions spread eastward in 1999. What makes the current drought somewhat unique is that the dry conditions have lasted past the summer and into the fall and winter. Many areas are not used to such a prolonged period of dryness.

The current drought started in 1999 and reached its peak in the summer of 2002. It is one of the worst droughts in U.S. history, with high temperatures and a lack of rain scorching crops, draining rivers and depleting reservoirs. Dust storms have raged in Montana, Colorado and Kansas, bringing back memories of the Dust Bowl in the 1930s. Last year, the largest wildfires in state history occurred in Colorado, Arizona and Oregon, causing the burning of some 7.1 million acres of forest land and marking the second worst fire season in U.S. history.⁴

Recent rainfall has ameliorated the drought conditions in some regions. For instance, northern Colorado, eastern Montana, and northern and eastern Wyoming

have seen significant improvements.⁵ However, 24 percent of the contiguous United States was in moderate-to-extreme drought in April 2003, although this is down from 37 percent in January 2003 and 50 percent during the summer of 2002. Yet, rain and snowfall were not sufficient to end the severe-to-exceptional drought conditions across Utah, Nevada, Arizona, northern New Mexico, southwestern Wyoming, and southern and western Colorado, where severe drought has occurred for much of the past three to five years.

Despite some temporary improvement, University of Arizona data suggest that the Great Plains, the Rockies and the Southwest may be suffering from an episodic drought that could last from a few years to several decades.⁶ Droughts that spread across the United States over the past four years may have been linked by a common thread: ocean conditions created by a warming climate. A new study suggests that cold sea surface temperatures in the eastern tropical Pacific and warm sea surface temperatures in the western tropical Pacific and Indian Oceans worked together to cause widespread drying.⁷ In addition, global warming is predicted to have a devastating effect on the availability of water in the western United States.⁸

Water Quality

The recent drought has hampered freshwater quality in some parts of the country, exacerbating traditional concerns about water pollution. With water levels diminishing in lakes and rivers, water quality can be altered in a variety of ways.

One environmental concern created by lower water levels relates to fertilizers, oil drippings from automobiles and other chemicals that accumulate in water systems. With lower water levels, normal accumulations can become toxic to fish and plant life. At normal levels of surface water flow, toxic chemicals are diluted as a natural filtration occurs. But standing water can affect the overall water quality for the entire ecosystem.

Another environmental concern is that lower water levels produce unusually high temperatures because of lack of water flow. Lower water levels allow water temperatures to rise, which can affect biological habitats living within ecosystems. Warm water temperatures promote the growth of algae. As algae growth increases, it can quickly take over a small lake or pond. The Deer Creek Reservoir in Utah, for instance, has suffered from high algae growth and an extensive drought. The reservoir has dropped 43 feet over the past two years with no relief expected.⁹ High algae content throughout the reservoir has whittled away the shallow beaches, driving off many tourists.

Overuse and Overallocation

Although overuse and overallocation could be classified as water demand issues, these practices also affect water supply. Several past and current water conflicts stem from overallocation and overuse of water. Some interstate compacts granted rights to more water than existed in rivers. States used all the amount of water originally allocated, which turned out to be more than the average annual yields.

In some cases, this overallocation was not a major problem until the water supply started to diminish. A case in point is the 1922 Colorado River Compact, which was mentioned previously. When the compact was signed, the river's predicted annual yields were based on 20 years of data, which is not long enough to take variability into account. The problem is that allocations are 20 percent more than the actual yields of the river.¹⁰

Like overallocation, overuse also diminishes the water supply. For example, massive irrigation in western Kansas is depleting the Ogallala Aquifer, which is the major water source for the western and central parts of the state. Similarly, some farmers in California's Central Valley have pumped so much groundwater for irrigation that the land is collapsing, making it difficult to refresh aquifers during wet periods.

Water Infrastructure Quality

Another factor that can affect water supply is infrastructure quality. Across the country, water facilities are aging. Many water storage and delivery systems, especially in the West, are 50- to 100-years-old; consequently, they are not always in perfect shape. For instance, some canals can lose up to half of their irrigation water supplies because of seepage.¹¹ This problem is not confined to the western part of the United States. Experts estimate that between 10 percent and 40 percent of the freshwater pumped through pipes worldwide is lost to leaks and bad meters.¹²

Old, decaying infrastructure wastes water and money. According to Detroit water officials, leaking water pipes in Detroit lost more than 35 billion gallons of water, costing residents \$23 million in 2003.¹³ And the leakage works both ways: a recent study found that 60 percent (180 million gallons per day) of the total wastewater treated by Boston's central treatment plant was actually potable groundwater and storm runoff that had leaked into cracked sewage pipes, depleting freshwater supplies and putting unnecessary stress on sewage treatment plants and budgets.¹⁴

Land Use

Urban sprawl can also affect a region's water supply. When land is paved for roads and parking lots, rainwater no longer seeps into the ground. The replenishment of groundwater sources is reduced, thereby reducing groundwater supply. Since groundwater sources often supply water to surface waterways, land development can reduce the supply of both groundwater and surface water.

In addition, development can lead to water pollution. For example, as rain washes away pollutants from parking lots and roads, they can ultimately end up in waterways. Furthermore, water that runs off nonporous surfaces, such as pavement, can overburden sewer systems, which then may release sewage into waterways. And pollution may decrease the amount of water that can be used by domestic, agricultural, commercial and industrial users.

Water Demand Issues

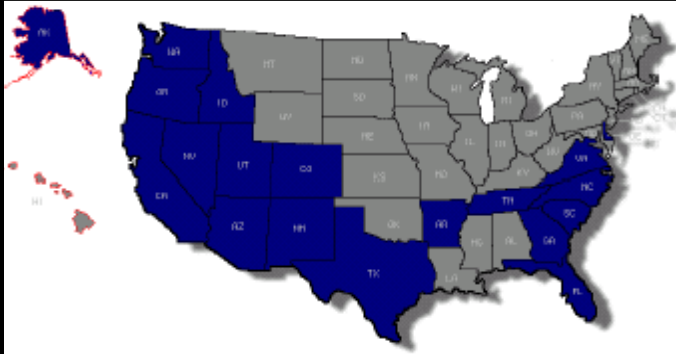
Water demand depends primarily on population growth. The more people there are, the more water they use. But demand also depends on trends in water usage. If water use grows even if the population doesn't, then water demand increases.

Population Growth

During the 1990s, much of the South and the West experienced above-average population growth, as shown in Figure 3.1. This trend is expected to continue for at least the next two decades.

The above-average population growth in the West is problematic because of below-average precipitation (see Figure 3.2). This, in turn, may lead to future water crises in some parts of the region, as illustrated in Figure 3.3.

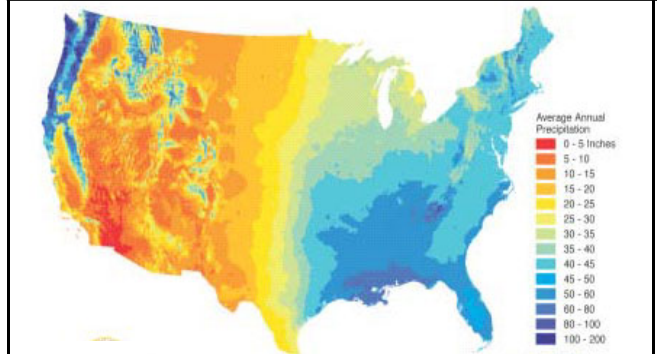
Figure 3.1: Percentage Population Growth Greater than National Average, 1990-2000



States in blue represent a growth rate greater than the national average of 13.2 percent over the decade

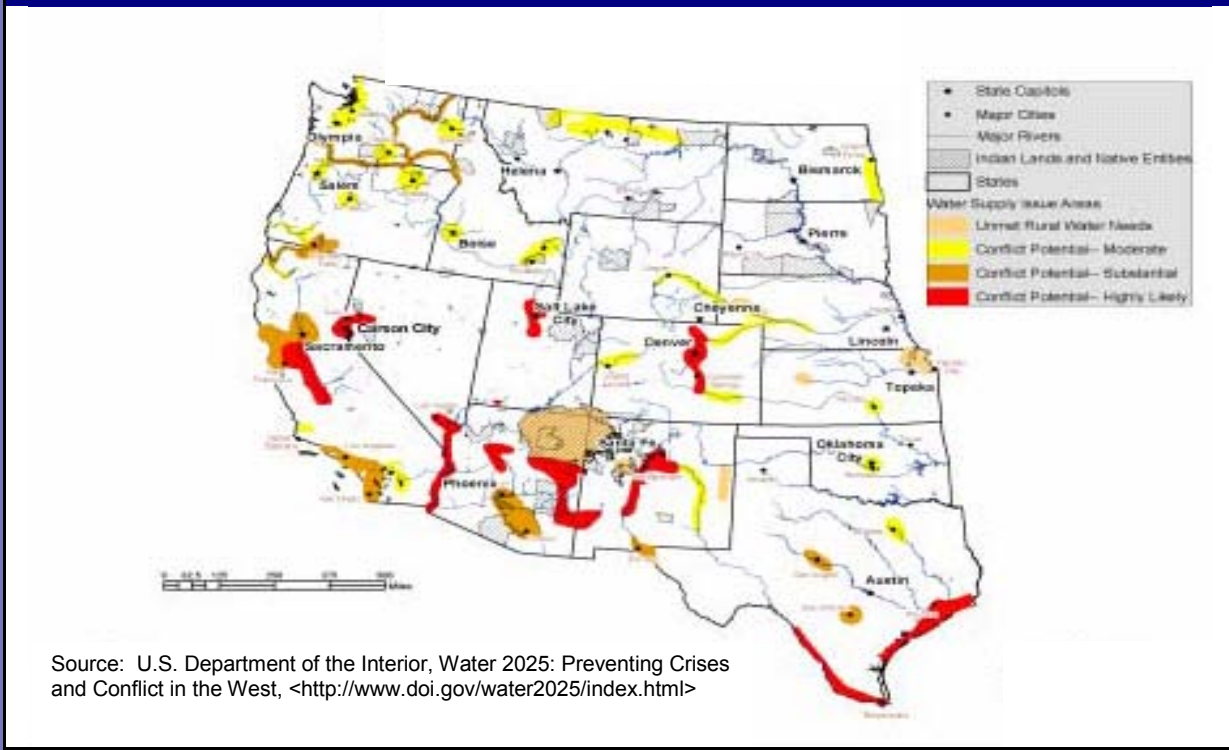
Source: U.S. Census Bureau, "Figure 1: Percent Change in Resident Population for the 50 States: 1990 to 2000," Geography Division 2001.

Figure 3.2: Average Inches of Annual Precipitation, 1961-1990



Source: U.S. Department of the Interior, Water 2025: Preventing Crises and Conflict in the West, <<http://www.doi.gov/water2025/index.html>>

Figure 3.3: Potential Water Crises in the West by 2025



Source: U.S. Department of the Interior, Water 2025: Preventing Crises and Conflict in the West, <<http://www.doi.gov/water2025/index.html>>

But potential water crises are not confined to the dry West. The historically water-rich South is also experiencing problems. The increase in water consumption is attributed to demographic shifts: population growth, population shifts to the coastal areas and increased urbanization of agricultural and forested areas. Since 1990, water consumption in the South has risen sixfold – more than twice the national rate.¹⁵

Population is becoming more concentrated in metropolitan areas. According to U.S. Census data, the population continues to migrate to metropolitan areas.¹⁶ Metropolitan growth accounted for most of the U.S. population growth in the 1990s. This sets up potential conflicts between urban and rural areas for the control of precious water resources.

Water Usage

Throughout the 20th century, growth in total water withdrawals consistently outpaced population growth. From 1900 to 1990, the annual rate of increase for population and water withdrawal was 1.2 percent and 2.4 percent, respectively; over the same period, per capita water withdrawal nearly quadrupled, from about 175 gallons per day in 1900 to roughly 1,350 gallons per day in 1990.¹⁷ This dramatic rise in water usage is largely attributable to increases in irrigation water and thermoelectric cooling, which together account for 83 percent of the total increase in water withdrawal from 1900 to 1990.

In the last few years, per capita water consumption has begun to decline. Whether this trend continues or not remains to be seen. What is known, however, is that while overall per capita use is decreasing, water use is growing faster than population in most cities.¹⁸ Obviously, urban areas are responsible for much of the growth in domestic water use. This growth in urban water demand could set the stage for more conflicts between urban and rural areas throughout the country.

While several factors are combining to limit water supply, at the same time demand for water is growing. This sets up the opportunity for more water conflicts in the future. If states want to avoid these conflicts, they need to take measures that affect the pressures on both water supply and demand.

4. What can be done?

While many water related programs are administered at the local level, states have developed policy and program responses to a wide variety of water related issues. Some policies and programs deal with water supply while others address demand. States have also created water plans, which address both supply and demand issues.

Water Supply

The era of big water projects is over. Fewer dams are being built. Reservoirs are expensive to construct. Instead of big construction projects, water supply management is now more focused on the transfer of existing water rights to their most beneficial and efficient users. In addition, planning for drought, maintaining good water quality, avoiding overallocation and overuse, improving infrastructure quality and incorporating water use into land use planning are also ways states can address water supply issues.

Water Rights Transfers

In states which recognize riparian water rights, the procedure for transferring rights is fairly straightforward: since the right to use water is tied to the ownership of the land bordering the water source, rights are transferred along with land. In the West, however, where water rights are not based on geographic proximity to a

water source, the procedure is much more complex, and varies greatly from state to state.

All Western states have statutorily defined procedures for changing water rights.¹⁹ In most states, transfers are handled by administrative action, although Colorado relies on a special water court. While each state has a unique set of laws, there are a few common themes:²⁰

- Parties must establish ownership of the water right (this is implied in many states).
- A change in water right must not injure others' water rights.
- A change must be in the "public interest" or "beneficial."
- In many states, water rights can be established for a future use without the water actually being used. This leaves the potential for abuse: people could simply buy up water rights without intending to use them, and then sell them for a profit later. In the past, many states required that water must actually have been used before a transfer can take place; this appears to be changing, however.
- To prevent owners from using transfers to resurrect an unused water right, many states require that the right must not have been previously abandoned or otherwise forfeited.

A number of states are increasingly using, to varying degrees, an alternative water rights transfer mechanism, which is most often called an "exchange." Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming all have some such mechanism. Exchanges can be enormously complicated, but in essence, they involve the owner of a junior water right satisfying a senior water right with another source of water in exchange for the use of water that would otherwise belong to the senior right holder. Exchanges can be very useful in adding flexibility to otherwise very rigid water rights. They typically require that the owner of a junior right provide water "in amount, timing, and quality" sufficient to meet the needs of the senior right's owner without injuring others' water rights.²¹

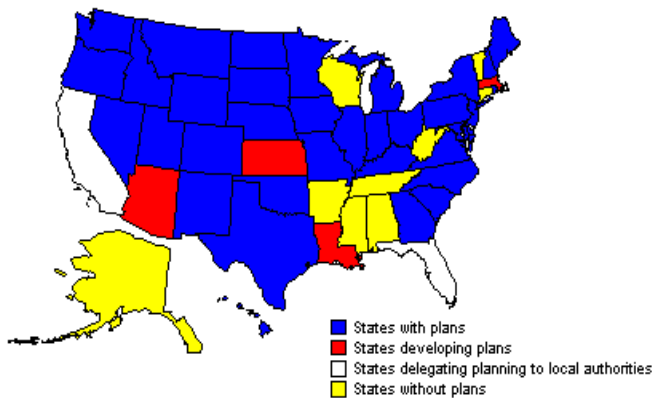
In some states, the temporary or permanent transfer of water rights is a lengthy and complicated process. Therefore, some government officials are addressing these concerns in order to expedite the transfer of water rights, especially in times of drought.

Water rights transfers do not have to be permanent. Water rights holders can temporarily lease their water rights. One way to do this is through a water bank. A water bank, which can be administered by a state agency, serves as a broker between users wanting to lease water rights and users who want to give up their water rights for a limited time. Some states, including Colorado and Texas, already have water banking programs.

Changes in Climate

States may not be able to change the climate, but they can change the way they react to climate changes. In 1976, no state had a drought plan. As of April 2003, 35 states have drought plans, two entrust the plans to local authorities and four are developing plans.²² The importance of drought planning is evident because the effects of drought are staggering. Drought costs agriculture, transportation, recreation, forestry and energy about \$6 billion to \$8 billion each year.²³

Figure 4.1: Drought Planning in the States, April 2003



Source: National Drought Mitigation Center, NDMC Online, 1 June 2003, <<http://www.drought.unl.edu/index.htm>>.

There are three major elements of a drought plan.²⁴ First, an early warning system detects the onset of drought based on long-term weather forecasting and monitoring of such parameters as temperature and precipitation, stream flow, reservoir and ground water levels, snowpack and soil moisture. Second, risk and impact assessment procedures are used to address the economic uncertainty associated with future climate changes. Third, a drought plan should include mitigation

and response strategies that are implemented in advance to reduce the degree of risk to people, property and productive capacity.

Water Quality

Over the last few years, the use of water for recreational and environmentally restorative uses has been considered a “beneficial use.” Water used to provide recreational opportunities or preserve natural habitat can be beneficial, both from a societal and economic perspective – after all, pristine riverbanks and exciting whitewater attract tourists, who in turn pump much-needed dollars into rural economies.

Legislators in many states have responded to public demand by implementing “minimum flow” requirements to balance existing water rights. By requiring that rivers not be allowed to drop below a certain minimum level, these requirements prevent situations in which individuals or groups can use a great deal of water simply by using the water to which they own the rights, thereby hurting the ecology of water sources. Minimum flow requirements also address the problem of overuse.

Overallocation and Overuse

Many water sources have been overallocated because water rights were based on inaccurate predictions. One of the main contributors to inaccurate forecasting is the lack of data. Data on water supply and use are not readily available or aren’t collected. To possibly alleviate current overallocation problems, states could focus on data gathering.

Overuse of water sources is also aided by a lack of data. States often do not have information on how much water is extracted from sources, what pumping practices are used or how fast the water is recharged. The first step in making sure that users do not extract excessive amounts of water is to find the overusers and analyze why they overuse.

States have taken other actions to curb overuse. Maine recently passed a law that requires major water users to file annual water use reports and allows the state environmental protection agency to designate areas that are in danger of overuse. New Hampshire passed a law that limits commercial withdrawals of water.

Because groundwater use is not strictly regulated in some states, there is a potential for overuse. To get at this issue, Washington recently passed a law requiring permits for drilling wells. And the Arizona Legislature has passed a law prohibiting Phoenix and its suburbs from pumping groundwater faster than it can be replenished.

Infrastructure Quality

Leaks in water canals and pipes can be detected on-site or remotely with different types of equipment. Leak detection can bring big payoffs. For every \$1 spent on modernizing canals, states can reap \$3 to \$5 in conserved water; for every \$1 spent maintaining canal lining, states can reap up to \$10 in conserved water.²⁵

Leak detection is beneficial for both irrigation infrastructure and drinking water infrastructure. Detecting and repairing leaks in pipes is one of the main efforts of the Massachusetts Water Resources Authority, which serves more than 2 million people. And New York City uses sonar leak detection devices and a flow-monitoring program to detect leaks.

In addition to repairing leaks, water officials may consider a water loss prevention program, which can include various elements such as inspecting, cleaning and lining pipes. These maintenance efforts are designed to prevent leaks in the first place.

Land Use

States are introducing smart growth policies to combat urban sprawl, preserve the environment and improve the quality of life. Some states are beginning to coordinate state government agencies that affect development, including water related agencies. Furthermore, some states are realizing that population growth and land use issues are creating a need for regionalism.

Only a handful of states have created statewide land use planning standards. However, in terms of ensuring adequate water supply, California has enacted legislation that links water supply with land use. California state law requires developers proposing subdivisions of 500 or more houses and large commercial projects to show that water will be available for to meet these domestic and commercial needs even during prolonged droughts. In addition, another California law requires cities and counties to create water supply assessments for large development projects.

Water Demand

States can't easily change their demographics, but they can encourage conservation efforts to stem the growing demand for water. Conservation efforts can be aimed at commercial, industrial and domestic users.

Conservation

As the EPA points out, there are a couple of sizeable obstacles standing in the way of most water conservation efforts:²⁶

- The “use it or lose it” nature of prior allocation water rights law encourages waste. If water rights owners don't consume all of their allotments, they risk losing their rights to that water in the future. This creates a perverse incentive to waste water in order to ensure future access. The EPA suggests that states consider “conserved surplus” laws, which allow owners to retain water rights if the conserved water is put to beneficial use, presumably by being transferred to other landowners and users.

- Pricing strategies can be effective in curbing water usage: if water costs more, people use less. However, implementing conservation-friendly water pricing can be difficult. Public utility commissions typically wish to avoid the political fallout that accompanies rate hikes. The existing regulatory structure for most water utilities, however, does not leave utilities with much pricing flexibility: rate caps keep utilities from hiking prices to make profits, so utilities can only maximize revenue by delivering more water to existing customers. Naturally, this does not give utilities an incentive to ask customers to conserve.

Despite these obstacles, conservation is an increasingly popular way to mitigate water demand. Still, there are few laws that actively require serious conservation: most federal efforts at encouraging conservation are strictly voluntary and asking people to cut their water usage can be a tough sell. With a large portion of the western United States suffering from a severe drought, efforts to stretch dwindling water supplies appear to be slowly gaining political momentum.

There are many conservation techniques that states can encourage among industrial, commercial and residential water users.²⁷ Some of these approaches are highlighted below.

Measurement of water usage. This basically means metering. It includes source-water metering, service-connection metering and public-use water metering. Interestingly, many of the biggest water savers are fairly basic concepts like metering. Metering and submetering, for example, can reduce usage by 20 percent to 40 percent.²⁸ Submetering for irrigation water can lead to more efficient landscaping and irrigation practices. Water officials can also use submetering to create a separate rate structure for irrigation water.

States have taken notice. Georgia is considering requirements for water meters for multifamily and single-family homes, and legislation has been introduced in California that would require metering of water usage at all residences and most commercial buildings statewide.

Pricing structures to promote efficient water use. A tiered rate structure can enhance conservation efforts. If residential, commercial and industrial users are rewarded by lower rates for using less water, this will lead to efficiencies. Some water systems already do this. Albuquerque, New Mexico, for example, adds a summer surcharge when customers use more than 200 percent of their average water use in the winter. Some places have tiered pricing structures in which users pay a certain rate for one range of water use, a higher rate for another range of water use and an even higher rate for even more water use.

Audits of domestic, commercial and industrial users. Audits can help customers understand their water usage patterns and identify ways they can conserve water and lower their water bills. This can be done for all types of users. For instance, water officials in some towns do audits of residential water needs, specifically landscaping and home irrigation.

Audits of commercial and industrial users are also becoming more common. Audits of large-volume users should identify the different categories of water use, such as process cooling and heating, and then suggest areas where efficiency can be improved and the technologies and practices that can be used to make these improvements.²⁹ In Albuquerque, for example, water officials visit factories and other large-volume users to audit their water use and require customers that use more than 50,000 gallons daily to implement a water conservation plan.

Promotion of efficient landscaping and irrigation. States can promote drought-resistant landscaping and efficient irrigation practices. Water officials can do audits of outdoor water use for domestic, commercial and industrial customers. They can also work with government officials to ensure that new and existing public parks, the grounds of public buildings and public golf courses use water efficient landscaping. Water efficient landscaping and irrigation can also be promoted through the cooperative extension service, as it is in Greensboro, North Carolina.

In addition to promoting certain landscaping plants and techniques, states and water officials can support efficient irrigation techniques. Some places restrict outdoor water usage and require users to irrigate at certain times and use drip irrigation rather than hose irrigation. Saving water through better irrigation practices is an efficient conservation method because users tend to overwater lawns and plants. Georgia is considering permanent constraints on outdoor watering rather than temporary constraints during droughts. The state is also considering requirements for rain sensors on outdoor watering systems that turn off when watering is unnecessary.

Water reuse and recycling. States can encourage the recycling and reuse of graywater from sinks, showers and baths. Water officials can help identify potential uses for graywater, such as industrial applications, agricultural irrigation, groundwater recharge and direct reuse. Gilbert, Arizona, with some help from state government, reclaims and reuses much of its water to recharge groundwater. Some localities, mostly in the West, require businesses that use large amounts of water, such as car washes, to use recycled water.

Management of water system pressure. By reducing systemic water pressure, officials can decrease the number of leaks and the amount of water that escapes through these leaks. Water pressure reduction can also reduce deterioration of pipes and other equipment, thus decreasing the need for repairs. Additionally, water pressure reduction can reduce the wear and tear on customers' fixtures and appliances. Water officials can reduce system-wide pressure in conjunction with state and local regulations and may also help customers install pressure-reducing valves.

Retrofit and replacement of water fixtures and encouragement of water efficient appliances. Retrofit refers to improvements in existing fixtures while replacement refers to substituting high-efficiency fixtures for low-efficiency ones. Both the retrofit and replacement of plumbing fixtures are designed to increase the efficiency of indoor water use.

A basic retrofit kit includes things such as low-flow faucet aerators, low-flow showerheads, leak detection tablets and replacement flapper valves. These kits are often provided free of charge or at cost.³⁰ The retrofit of plumbing fixtures can be done in conjunction with water audits.

Water officials can facilitate replacement by providing free fixtures, offering rebates to consumers who purchase their own fixtures or negotiate with suppliers to provide lower-cost fixtures. Some states require or promote replacement of inefficient water fixtures. For instance, one of the largest programs of the Metropolitan Water District of Southern California involves rebates for replacing pre-1992 toilets with high-efficiency toilets. Albuquerque, New Mexico gives rebates on water bills to residents who install low-flow toilets and efficient shower heads.

Some states have gone one step further and addressed water-using appliances. For instance, California, Texas and Washington require water efficiency in clothes washers. Georgia is also considering requirements for water-efficient plumbing fixtures and incentives for water efficient washing machines. Water-efficient home appliances, such as washing machines, and plumbing fixtures, such as toilets and shower heads, and garden irrigation systems can decrease water use by 30 percent.³¹

Conservation education. Conservation education can entail a wide variety of tactics. Education can include relatively simple methods such as making water bills easier to read and including conservation tips in water bills. It can also include creating conservation programs for schools, embarking on public education programs through printed and video materials and working through civic organizations to establish workshops to teach industrial users conservation methods. Conservation education can pay off. Education programs and voluntary limits on water consumption can decrease short-term needs by 10 percent to 20 percent.³²

States can focus on curbing water demand through conservation and on increasing water supply through methods such as those mentioned earlier. Water management planning is a way of dealing with both supply and demand and preparing for changes in both.

Water Management Planning

As the saying goes, “An ounce of prevention is worth a pound of cure.” One way to mitigate the effects of future water shortages and subsequent water rights disputes is to address future water supply and predicted water demands.

Water plans should include predictions of future water supply levels, including the effects of possible climate changes. Plans can include an account of existing and possible water sources and an assessment of water management alternatives.

Demand forecasts can be done for five-, 10- and 20-year periods. It is often more accurate to prepare forecasts for different water uses, such as domestic, agricultural, industrial and commercial. Water demand forecasts can include anticipated demand for water, factor in possible adjustments to demand and analyze several “what if” scenarios.³³ Water plans can address issues such as competition among water users and methods of conflict resolution.

The latest drought encouraged some states to look more closely at water planning. The drought played a role in the passage of Pennsylvania’s Water Resources Act, ending a 20-year quest to address the lack of water resource planning. The act requires the development of a new state water plan over the next five years working with both regional and statewide water resources advisory committees whose membership includes environmental, local government, technical and water user interests. Water planning was recently brought to the forefront in Delaware as well, where officials have requested reviews of the state water plan. New plans are asked to assume lengthier droughts and place new restrictions on using Brandywine Creek, the region’s largest regular supply.

Conclusion

Dwindling supply and growing demand for water are creating conflicts among water users throughout the country. Water supply depends on a variety of factors, including changes in climate conditions, changes in water quality, overallocation and overuse, infrastructure quality and patterns of land use. Water demand depends primarily on population growth and trends in water usage.

States have begun to address both supply and demand issues. On the supply side, states can promote transfers of water rights, create drought plans, encourage good water quality through minimum streamflow requirements, discourage overuse, improve infrastructure quality and integrate water use planning with land use planning. On the demand side, states have a wide variety of conservation programs from which to choose, ranging from universal metering and tiered pricing structures to promotion of efficient landscaping and water recycling and reuse. States should also consider comprehensive water plans that address both supply and demand issues.

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Appendix: Glossary of Terms

Drought: A period of abnormally dry weather, which persists long enough to produce a serious hydrologic imbalance (for example crop damage, water supply shortage, etc.)

Groundwater: Sources of water below the water table.

Irrigation: The distribution of water applied to lands to accommodate the needs of plants not met by rainfall.

Riparian Rights: The rights of a landowner to use water from an adjacent body of water.

Stream Flow: A term used indicating the rate or quality of water flowing in a stream or creek.

Surface Water: Water that is naturally open to the atmosphere, such as lakes, rivers, seas and reservoirs.

Water Banking: The process of one water rights holder leasing water rights to another holder for a temporary amount of time.

Watershed: A region of land that is comprised of rivers and streams that flow into a larger body of water.